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A New Species of *Gentiana* Sect. Chondrophyllae Ser. Capitatae (Gentianaceae) from East Nepal

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A new species of *Gentiana* sect. Chondrophyllae ser. Capitatae is described from east Nepal. The species, named *Gentiana sagarmathae*, is distinguished from the resembling species by the shape and size of several floral characters.

In *Gentiana* series Capitatae T. N. Ho of sect. Chondrophyllae Bunge is represented by sixteen species distributed in Kashmir to Himalaya (including N. Burma), SW. China, Indochina, Central America and North Africa (Ho and Liu 1990). In Nepal three species, *G. albicalyx* Burkill, *G. capitata* Buch.-Ham. ex D. Don, *G. kumaonensis* Biswas are found in this series (Chater 1982).

The first author collected unknown species in the alpine zone of the Khumbu Himal, east Nepal in 1992. This resembles *Gentiana kumaonensis* and *G. capitata*, and occurs sympatrically in some places in Khumbu Valley. This paper aims to publish the species and note the differences among the species of the Capitatae in Nepal.

The species, named *Gentiana sagarmathae*, is closely related to *Gentiana kumaonensis* and *G. capitata*, but differs from the former in having short stigma and from the latter in having entire plicae between corolla lobes.

The species is meaningfully smaller than the two species in the size of various floral characters (Table 1). Seventeen floral characters of *G. sagarmathae* and the two related species were measured and analyzed by principal component analysis. The cumulative ratio of eigenvalues of the first to the second principal component amounts to 85%. The first component accounts for 78% of the total variance. Characters with heavy loadings in the first component are almost size of floral characters (Table 2).

Three species were clearly separated into three parts in the two dimensional plots of the first principal component against the second (Fig. 3). The plots of *G. sagarmathae* are gathered at the left side. Though *G. sagarmathae* is similar to the small individuals of *G. kumaonensis*, it differs greatly those from that in the size of several floral characters (Table 1 and Fig. 3).

Gentiana sagarmathae was collected in elevation between 3500 m and 4400 m, while *Gentiana kumaonensis* and *G. capitata* were collected in the places lower than 3600 m in the same district. The flora published by Miehe (1987) did not mention

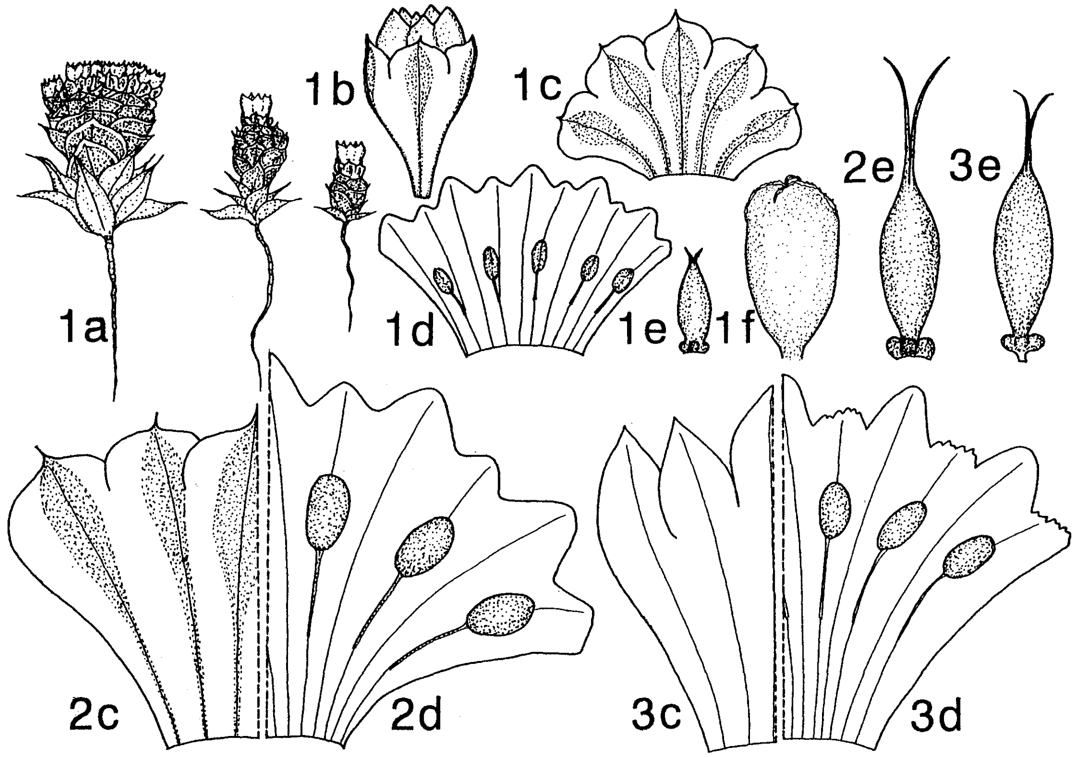

Fig. 1. *Gentiana sagarmathae, G. kumaonensis* and *G. capitata*. 1: *G. sagarmathae* (holotype). 2: *G. kumaonensis*. 3: *G. capitata*; a: Habit (×3.3). b: Flower (×5.4). c: Calyx (×5.4). d: Collora and stamen (×5.4). e: Pistillate (×5.4). f: Capsule (×5.4).

about *Gentiana* species.

Taxonomic treatment

Gentiana sagarmathae Miyam. & H. Ohba, sp. nov. (Fig. 1)

Ex affinitate *Gentianarum kumaonensi* Biswas *capitatae* Buch.-Ham. ex D. Donis que ab illa stigmatibus brevissimis longitudine 0.25–0.57 mm ab hac plicis inter lobos corollae integris satis diagnoscenda.

Stems 0.7–1.5 cm tall, mamillate, branched or sometime simple. Leaves closely clustered; radical leaves lanceolate or ovate-lanceolate, 1–5 mm long, 0.8–3.0 mm wide, margin entire; cauline ones obovate, 1.5–6.0 mm long, 1–5 mm wide, apex aristate-acute, margin membranous, white, entire, upper surface greyish green. Flowers sessile, solitary on branches, 3.0–4.5 mm long, 1.7–3.0 mm wide (Fig. 1). Calyx campanulate, 2.5–3.6 mm long; lobes 5, oblong to ovate, 0.8–1.5 mm long, 0.8–1.7 mm wide, apex aristate-acute, margin entire, membranous, white (Fig. 1c). Corolla blue or white-blue, campanulate, 3–4 mm long, 1.5–2.3 mm wide; lobes 5, short triangular or round, 0.37–0.90 mm long, 0.68–0.91 mm wide, apex usually obtuse; plicae between lobes shorter than corolla, triangular, 0.20–0.35 mm long, 0.48–0.80 mm wide, margin entire (Fig. 1d). Stamens 5, 1.4–2.4 mm long; anthers elliptic, 0.42–0.68 mm long; filaments attached to lower 1/2 of corolla-tube (Fig. 1d). Pistils 1.8–3.8 mm long, elliptic, sessile; stigma bifid, 0.25–0.57 mm long (Fig. 1e). Capsules oblong, ca 4 mm long, stigma persistent, recurved (Fig. 1f). Seed fusiform.

Type. East Nepal: Sagarmatha zone, Solkhumbu

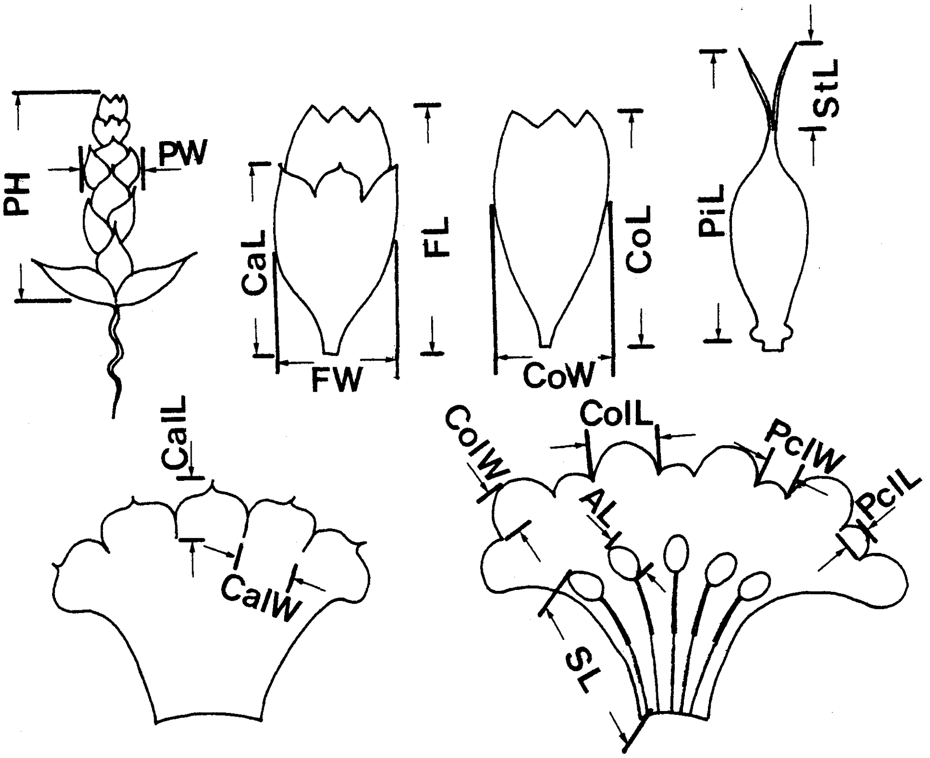

Fig. 2. 17 characters used for principal component analysis. PL: High of plant. PW: Width of plant. FL: Length of flower. FW: Width of flower. CaL: Length of calyx. CaLL: Length of calyx lobe. CaLW: Width of calyx lobe. CoL: Length of corolla. CoW: Width of corolla. CoLL: Length of corolla lobe. CoLW: Width of corolla lobe. PcLL: Length of paracorolla lobe. PcLW: Width of paracorolla lobe. SL: Length of stamen. AL: Length of anther. PL: Length of pistillate. StL: Length of stigma.

Distr., Namche (3500 m)–Phurte (3600 m). On exposed sandy slopes, 21 March 1992, F. Miyamoto, K. Miyamoto & T. Nakaaki 2011 (TI-holo: KATH, A, BM-iso).

Specimens examined (specimens in all TI). East Nepal: Sagarmatha Zone, Solkhumbu Distr.: Dole (4100 m)–Phortse Temga (4000 m), F. Miyamoto et al. 2001, 20 March 1992; Thame (3800 m)–Samde (3600 m), F. Miyamoto et al. 2003, 22 March 1992; Luza (4400 m)–Dole (4100 m), F. Miyamoto et al. 2006, 20 March 1992; Phurte (3600 m), F. Miyamoto et al. 2008, 21 March 1992.

Endnote

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Miehe G. 1987. An annotated list of vascular plants collected in the valleys south of Mt Everest. Bull. Brit. Mus. Nat. Hist. (Bot.) **16**: 225–268.

Table 1. Size of 17 characters in three species of Gentiana. Character's abbreviation is indicated in Fig. 2

Species Characters		*G. sagarmathae*			*G. kumaonensis*			*G. capitata*		
		Mean±SD	Max.	Min.	Mean±SD	Max.	Min.	Mean±SD	Max.	Min.
PH	(mm)	7.87±2.01	12.2	5.3	14.84±8.99	33.0	3.9	12.20±4.14	21.5	8.3
PW	(mm)	5.79±3.01	11.6	2.1	6.81±4.34	15.0	1.6	14.12±5.86	22.0	7.5
FL	(mm)	3.92±0.40	4.4	3.1	9.39±1.71	12.1	6.0	7.78±0.84	8.7	6.5
FW	(mm)	2.22±0.29	2.9	1.7	3.22±0.96	5.1	1.6	3.68±0.38	4.1	2.8
CaL	(mm)	3.09±0.36	3.6	2.5	6.98±1.61	8.7	3.7	6.18±1.05	7.6	4.6
CaLL	(mm)	1.09±0.19	1.4	0.8	2.06±0.56	3.0	1.1	2.07±0.30	2.5	1.5
CaLW	(mm)	1.26±0.21	1.6	0.9	1.79±0.51	2.5	0.9	1.72±0.19	2.0	1.2
CoL	(mm)	3.57±0.30	4.0	3.0	8.85±1.56	11.0	5.6	7.42±0.73	8.7	6.2
CoW	(mm)	1.90±0.21	2.3	1.5	3.81±0.95	5.1	2.0	3.59±0.47	4.1	2.3
CoLL	(mm)	0.47±0.06	0.5	0.3	1.03±0.22	1.4	0.7	0.90±0.16	1.2	0.7
CoLW	(mm)	0.79±0.07	9.1	0.6	1.61±0.37	2.2	0.9	1.50±0.17	1.7	1.2
PcLL	(mm)	0.25±0.05	0.3	0.2	0.66±0.09	0.8	0.4	0.50±0.09	0.6	0.3
PcLW	(mm)	0.71±0.09	0.8	0.4	1.30±0.23	1.6	0.8	1.11±0.17	1.4	0.8
SL	(mm)	2.02±0.27	2.3	1.4	5.92±1.86	8.3	2.5	5.33±0.66	6.0	4.0
AL	(mm)	0.58±0.08	0.6	0.4	1.28±0.40	1.8	0.6	1.10±0.16	1.4	0.1
PL	(mm)	2.40±0.54	3.8	1.8	6.75±1.08	8.6	5.0	5.86±0.99	7.3	4.3
StL	(mm)	0.36±0.08	5.7	0.2	2.36±0.36	2.7	1.8	1.35±0.21	1.6	0.9

Table 2. Cumulative variance of the first three principal components and loadings of 17 characters on each principal component. Character's abbreviation is indicated Fig. 2

Cumulative variance	C1 78%	C2 85%	C3 90%
Characters			
PH	0.199	0.223	0.611
PW	0.139	0.685	0.106
FL	0.267	−0.116	0.112
FW	0.220	0.347	−0.438
CaL	0.269	0.049	0.056
CaLL	0.251	0.094	0.142
CaLW	0.223	0.243	−0.396
CoL	0.267	−0.140	0.017
CoW	0.234	−0.048	−0.424
CoLL	0.245	−0.182	0.056
CoLW	0.263	−0.014	−0.018
PcLL	0.246	−0.273	−0.079
PcLW	0.261	−0.040	0.060
SL	0.259	−0.064	0.042
AL	0.251	0.074	0.189
PL	0.261	−0.075	−0.014
StL	0.236	−0.359	0.009

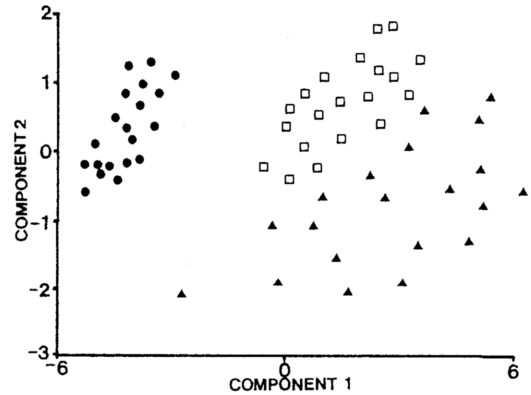

Fig. 3. Scatter diagram of the first principal component to the second. ● : *Gentiana sagarmathae*, ▲ : *G. kumaonensis*, □ : *G. capitata*.

宮本　太・大場秀章：**東ネパール産リンドウ属の一新種**

東ネパール，サガルマタにおいて発見されたリンドウ属植物を記載した．本種はハルリンドウ節Capitatae列に属するもので*Gentiana kumaonensis* Biswasおよび*G. capitata* Buch.-Ham. ex D. Donに近縁なものである．しかし，前種とは花柱の形態および後種とは副花冠が全縁であることで明確に区別できる．本種は3600 mから4600 mの高山帯における乾燥した砂地に生息していた．3月は開花している植物も少なく，これまで植物学的な調査はあまりおこなわれてこなかったので，本種のようなハルリンドウ節の小型植物はまだ見逃されていることが多いと思われる．